

#5

Sub  
B27



2272704080.ST25.txt  
SEQUENCE LISTING

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<110> Bisaro, David M.

<120> Mutant Forms of the AL2 Gene of Geminiviruses

<130> 22727/04080

<140> 09/719,024

<141> 2000-12-05

<150> PCT/US99/12680

<151> 1999-06-04

<160> 75

<170> PatentIn version 3.1

<210> 1

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<212> PRT

<213> Tomato golden mosaic virus

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Arg Ala Ala Lys Arg Arg Ala Ile Arg Arg Arg Arg Ile Asp Leu Asn  
20 25 30

Cys Gly Cys Ser Ile Tyr Ile His Ile Asp Cys Arg Asn Asn Gly Phe  
35 40 45

Thr His Arg Gly Thr Tyr His Cys Ala Ser Ser Arg Glu Trp Arg Leu  
50 55 60

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Tyr Leu Gly Ile Asn Lys Ser Pro Leu Phe Gln Asp Asn Gln Arg Arg  
65 70 75 80

Gly Ser Pro Leu His Gln His Gln Asp Ile Pro Leu Thr Asn Gln Val  
85 90 95

Gln Pro Gln Pro Glu Glu Ser Ile Gly Ser Pro Gln Gly Ile Ser Gln  
100 105 110

Leu Pro Ser Met Asp Asp Ile Asp Asp Ser Phe Trp Glu Asn Leu Phe  
115 120 125

Lys

<210> 2

<211> 129

<212> PRT

<213> Abutilon mosaic virus

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Arg Gln Ala Lys Arg Arg Ala Ile Arg Arg Arg Arg Ile Asp Leu Gln  
20 25 30

Cys Gly Cys Ser Ile Tyr Phe His Ile Asp Cys Thr Gly His Gly Phe  
35 40 45

Thr His Arg Gly Thr His His Cys Thr Ser Gly Gly Glu Trp Arg Val  
50 55 60

Tyr Leu Gly Asp Lys Lys Ser Pro Val Phe Gln Asp Val Gln Ser Arg  
65 70 75 80

Arg Thr Ile Ile His Gln Asn Glu Asn Ile Pro Cys Thr Asn Thr Val  
85 90 95

Gln Pro Gln Pro Glu Glu Ser Val Ala Ser Pro Gln Ser Leu Pro Glu  
100 105 110

Leu Pro Ser Leu Asp Asp Ile Asp Glu Ser Phe Trp Val Asn Leu Phe  
115 120 125

Ser

&lt;210&gt; 3

&lt;211&gt; 129

&lt;212&gt; PRT

&lt;213&gt; Abutilon mosaic virus

&lt;400&gt; 3

Met Arg Ser Ser Ser Pro Ser Gln Pro Pro Ser Ile Lys Lys Ala His  
 1 5 10 15

Arg Gln Ala Lys Arg Arg Ala Ile Arg Arg Arg Arg Ile Asp Leu Gln  
 20 25 30

Cys Gly Cys Ser Ile Tyr Phe His Ile Asp Cys Thr Gly His Gly Phe  
 35 40 45

Thr His Arg Gly Ile His His Cys Thr Ser Gly Gly Glu Trp Arg Val  
 50 55 60

Tyr Leu Gly Asp Ser Lys Ser Pro Val Phe Gln Asp Ile Gln Ser Arg  
 65 70 75 80

Gly Pro Ala Ile His Gln Asn Glu Asp Ile Pro Cys Thr Asn Thr Val  
 85 90 95

Gln Pro Gln Pro Glu Glu Ser Val Ala Ser Pro Gln Ser Leu Pro Glu  
 100 105 110

Leu Pro Ser Leu Asp Asp Phe Asp Asp Ser Phe Trp Val Asn Leu Phe  
 115 120 125

Lys

&lt;210&gt; 4

&lt;211&gt; 129

&lt;212&gt; PRT

&lt;213&gt; Bean dwarf mosaic virus

&lt;400&gt; 4

Met Gln Ser Ser Ser Leu Ser Thr Pro Pro Ser Ile Lys Lys Ala His  
 1 5 10 15

Arg Gln Ala Lys Arg Arg Ala Ile Arg Arg Arg Arg Ile Asp Leu Glu  
 20 25 30

Cys Gly Cys Ser Ile Tyr Thr His Ile Gly Cys Thr Gly His Gly Phe  
 35 40 45

Thr His Arg Gly Ala His His Cys Thr Ser Ser Arg Glu Trp Arg Val  
 50 55 60

Tyr Leu Gly Asp Arg Lys Ser Pro Leu Phe Gln Asp Ile Gln Ser Arg  
 65 70 75 80

Gly Thr Val Val His Gln Gln Gln Gly Ile Gln Arg Thr Asp Thr Val  
 85 90 95

Gln Pro Gln Pro Glu Glu Ser Val Ala Ser Pro Gln Ser Leu Pro Glu  
 100 105 110

Leu Pro Ser Leu Asp Asp Ile Asp Asp Ser Phe Trp Val Asp Leu Phe  
 115 120 125

Lys

&lt;210&gt; 5

&lt;211&gt; 129

&lt;212&gt; PRT

&lt;213&gt; Bean dwarf mosaic virus

&lt;400&gt; 5

Met Arg Ser Ser Ser Pro Ser Gln Pro Pro Ser Ile Lys Ala Gln His  
 1 5 10 15

Arg Ile Ala Lys Arg Lys Ala Ile Arg Arg Arg Arg Ile Asp Leu Asn  
 20 25 30

Cys Gly Cys Ser Ile Phe Tyr His Ile Lys Cys Ala Asp His Gly Phe  
 35 40 45

Thr His Arg Gly Glu His His Cys Ala Ser Gly Arg Glu Phe Arg Phe  
 50 55 60

Tyr Leu Gly Gly Thr Lys Ser Pro Leu Phe Gln Asp His Ala Gly Gly  
 65 70 75 80

Arg Ser Ser Ile His Thr Asp Lys Asp Ile Pro His Pro Ser Gln Val  
 85 90 95

Gln Ser Gln Pro Gln Glu Ser Thr Gly Ser Pro Gln Ser Ile Pro Glu  
 100 105 110

Leu Pro Ser Leu Asp Asp Ile Asp Ser Ser Phe Trp Asp Asp Ile Phe  
 115 120 125

Lys

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<211> 129

<212> PRT

<213> Bean dwarf mosaic virus

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 20 25 30

Cys Gly Cys Ser Ile Phe Tyr His Ile Lys Cys Ala Asp His Gly Phe  
 35 40 45

Thr His Arg Gly Glu His His Cys Ala Ser Gly Arg Glu Phe Arg Phe  
 50 55 60

Tyr Leu Gly Gly Thr Lys Ser Pro Leu Phe Gln Asp Asn Ala Gly Gly  
 65 70 75 80

Arg Ser Ser Ile His Thr Asp Lys Asp Ile Pro His Pro Asn Gln Val  
 85 90 95

Gln Ser Gln Pro Gln Glu Ser Thr Gly Ser Pro Gln Ser Ile Pro Glu  
 100 105 110

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Lys

<210> 7

<211> 129

<212> PRT

<213> Bean dwarf mosaic virus

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 20 25 30

Cys Gly Cys Ser Ile Phe Tyr His Ile Lys Cys Ala Asp His Gly Phe  
 35 40 45

Thr His Arg Gly Glu His His Cys Ala Ser Gly Arg Glu Phe Arg Phe  
 50 55 60

Tyr Leu Gly Gly Thr Lys Ser Pro Leu Phe Gln Asp His Ala Gly Gly  
 65 70 75 80

Arg Ser Ser Ile His Thr Asp Lys Asp Ile Pro His Pro Ser Gln Val  
 85 90 95

Gln Ser Gln Pro Gln Glu Ser Thr Gly Ser Pro Gln Ser Ile Pro Glu  
 100 105 110

Leu Pro Ser Leu Asp Asp Ile Asp Ser Ser Phe Trp Asp Asp Ile Phe  
 115 120 125

Lys

<210> 8

<211> 129

<212> PRT

&lt;213&gt; cabbage leaf curl virus

&lt;400&gt; 8

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Lys Ile Ala Lys Arg Arg Ala Val Arg Arg Arg Arg Ile Asp Leu Asn  
 20 25 30

Cys Gly Cys Ser Ile Phe Leu His Ile Asn Cys Ala Asp Asn Gly Phe  
 35 40 45

Thr His Arg Gly Glu His His Cys Ser Ser Gly Arg Glu Phe Arg Phe  
 50 55 60

Tyr Leu Gly Gly Ser Lys Ser Pro Ile Phe Gln Asp Thr Thr Arg Arg  
 65 70 75 80

Gly Pro Val Val His Gln Asn Gln Asp Leu Pro His Pro Ser Pro Val  
 85 90 95

Gln Pro Gln Pro Thr Glu Ser Ile Gly Ser Pro Gln Ser Leu Leu Gln  
 100 105 110

Leu Pro Ser Leu Asp Asp Phe Asp Glu Ser Phe Trp Ala Asp Ile Phe  
 115 120 125

Lys

&lt;210&gt; 9

&lt;211&gt; 129

&lt;212&gt; PRT

&lt;213&gt; Potato yellow mosaic virus

&lt;400&gt; 9

Met Arg Ser Ser Ser Pro Ser Gln Pro Pro Ser Ile Lys Lys Ala His  
 1 5 10 15

Arg Gln Ala Lys Lys Arg Ala Ile Arg Arg Arg Arg Ile Asp Leu Asp  
 20 25 30

Cys Gly Cys Ser Ile Tyr Phe His Ile Asp Cys Ala Gly His Gly Phe  
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35

40

45

Thr His Arg Gly Ala His His Cys Thr Ser Gly Arg Glu Trp Arg Val  
 50 55 60

Tyr Leu Gly Asp Arg Lys Ser Pro Leu Phe Gln Asp Lys Pro Ser Arg  
 65 70 75 80

Gly His Ala Ile His Gln Asp Gln Asp Ile Gln Arg Pro Asn Pro Val  
 85 90 95

Gln Pro Gln Pro Gln Glu Ser Ile Gly Ser Pro Gln Ser Ile Pro Glu  
 100 105 110

Leu Pro Ser Leu Asp Asp Ile Asp Asp Ser Phe Trp Val Glu Leu Phe  
 115 120 125

Ser

<210> 10

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<212> PRT

<213> Sida golden mosaic geminivirus

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 20 25 30

Cys Gly Cys Ser Ile Tyr Phe His Ile Gly Cys Thr Gly His Gly Phe  
 35 40 45

Thr His Arg Gly Thr His His Cys Thr Ser Phe Arg Glu Trp Arg Leu  
 50 55 60

Tyr Leu Gly Asp Arg Lys Ser Pro Leu Phe Gln Asp Ile Gln Gly Arg  
 65 70 75 80

Gly Ser Thr Val His Glu His Gln Asp Ile Gln Tyr Pro Asn Phe Val  
 85 90 95



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Gln Pro Gln Pro Glu Glu Ser Val Ala Ser Pro Gln Ser Val Pro Glu  
100 105 110

Leu Pro Ser Leu Asp Asp Ile Pro Asp Ser Phe Trp Val Asp Leu Phe  
115 120 125

Lys

<210> 11

<211> 131

<212> PRT

<213> Squash leaf curl virus

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Arg Ile Ala Lys Lys Arg Ala Val Arg Arg Arg Arg Ile Asp Leu Asp  
20 25 30

Cys Gly Cys Ser Ile Tyr Ile His Ile Asn Cys Ala Lys Asp Gly Asn  
35 40 45

Gly Phe Thr His Met Gly Arg His His Cys Ala Ser Gly Arg Glu Phe  
50 55 60

Arg Phe Tyr Leu Gly Gly Ser Lys Ser Pro Leu Phe Gln Asp Val Gln  
65 70 75 80

Arg Gly Gly Ser Thr Leu His Ala His Lys Asp Ile Pro His Thr Asn  
85 90 95

Pro Val Gln Pro Gln Pro Glu Glu Ser Thr Lys Ser Ser Gln Ser Val  
100 105 110

Pro Glu Leu Pro Ser Leu Asp Gly Ile Asp Ser Ser Phe Trp Asp Asp  
115 120 125

Ile Phe Glu  
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<210> 12

<211> 129

&lt;212&gt; PRT

&lt;213&gt; Tomato mottle virus

&lt;400&gt; 12

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 1 5 10 15

Arg Gln Ala Lys Lys Arg Ala Ile Arg Arg Arg Arg Val Asp Leu Gln  
 20 25 30

Cys Gly Cys Ser Ile Tyr Phe His Leu Gly Cys Ala Gly His Gly Phe  
 35 40 45

Thr His Arg Gly Thr His His Cys Thr Ser Gly Gly Trp Glu Arg Val  
 50 55 60

Tyr Leu Gly Ala Arg Lys Ser Pro Leu Phe Gln Asp Thr Gln Ser Arg  
 65 70 75 80

Gly Pro Thr Val Tyr Gln Asn Glu Gly Ile Pro Arg Thr Asp Thr Val  
 85 90 95

Gln Pro Gln Pro Glu Glu Ser Val Ala Ser Pro Gln Ser Leu Pro Glu  
 100 105 110

Leu Pro Ser Leu Asp Asp Val Asp Asp Ser Phe Trp Ile Asn Leu Phe  
 115 120 125

Ser

&lt;210&gt; 13

&lt;211&gt; 129

&lt;212&gt; PRT

&lt;213&gt; Texas pepper virus

&lt;400&gt; 13

Met Leu Asn Ser Ser Ser Ser Thr Leu Pro Ser Ile Lys Ala Gln His  
 1 5 10 15

Arg Ile Ala Lys Lys Arg Pro Ile Arg Arg Arg Arg Ile Asp Leu Asn  
 20 25 30

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Cys Gly Cys Ser Ile Phe Leu His Ile Asn Cys Ala Asn Asn Gly Phe  
35 40 45

Thr His Arg Gly Glu His His Cys Ala Ser Gly Arg Glu Phe Arg Phe  
50 55 60

Tyr Leu Gly Gly Ala Lys Ser Pro Ile Phe Gln Asp Thr Ala Arg Gly  
65 70 75 80

Gly Pro Val Val His Gln Asn Gln Asp Ile Pro His Arg Ser Pro Val  
85 90 95

Gln Pro Gln Pro Thr Ser Ser Ile Ser Ser Pro Gln Gly Ile Pro Pro  
100 105 110

Phe Pro Ser Leu Asp Asp Phe Asp Asp Ser Phe Trp Asp Asp Ile Phe  
115 120 125

Lys

<210> 14

<211> 29

<212> PRT

<213> Tomato golden mosaic virus

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<210> 15

<211> 21

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<211> 22

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<211> 28

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28

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<212> DNA

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27

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27

<210> 27

<211> 30

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<210> 28

<211> 27

<212> DNA

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<211> 39



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<210> 38

<211> 27

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<210> 40

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27

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<210> 49

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<223> PCR primer for site directed mutagenesis of AL2 gene

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27

<210> 56

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<212> DNA

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<210> 57

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<210> 59

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<212> DNA

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<210> 61

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<212> DNA

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<400> 61

cgcgagctcc ctctaaccct gtgtatgcg

29

<210> 62

<211> 27

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<220>

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cgcgaattcg ccgccatcga cgacagc

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<210> 64

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<210> 66

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<210> 67

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<223> PCR primer for site directed mutagenesis of AL2 gene

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<210> 69

<211> 29

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29

<210> 70

<211> 30

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30

<210> 71

<211> 29

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<210> 73

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<223> PCR primer for site directed mutagenesis of AL2 gene

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<212> DNA

<213> Artificial Sequence

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<223> PCR primer for site directed mutagenesis of AL2 gene

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<212> DNA

<213> Artificial Sequence

<220>

<223> PCR primer for site directed mutagenesis of AL2 gene

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27